Are Movie Release Windows for Theater, DVD, and Digital Sell-Through Collapsing? Empirical Evidence

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ABSTRACT

The distribution of motion pictures is going through a fundamental transformation. The primary channel has historically been the theater, and for the last few decades DVD distribution has been a profitable secondary channel. However, with the advent of the Internet, today a consumer can easily download movies via services like iTunes and Amazon Prime, and watch them on an ever broadening range of media players and mobile devices. We track movie releases in theaters in the 2012-2015 period, and then record the corresponding release dates and prices for DVD and three downloading services, otherwise known as digital-sell through (DST) services: iTunes, Amazon, and YouTube. In most situations, DST is typically released simultaneously with digital rental, so our data is representative of both. We find evidence that, during this period, the length of the DVD window has been relatively stable at three to four months, in line with empirical evidence and models that suggest there is an optimal DVD release window. We also find that the DST release window has been shrinking at a relatively fast rate and it has converged towards the DVD window. This trend is evident even after controlling for other factors that may affect movie release timing, such as season, box office revenues, and accounting for fixed effects across studios and channels. Moreover, in the first quarter of 2015, we find that on average DST was released earlier than DVD, effectively becoming the first secondary channel after theater.

Keywords: Digital transformation, digital distribution, channel strategy

INTRODUCTION

The distribution of motion pictures is going through a fundamental transformation. The primary channel has historically been the theater, and for the last few decades DVD distribution has been a profitable secondary channel. However, with the advent of the Internet, today a consumer can easily download movies via services like iTunes and Amazon Prime, and watch them on an ever broadening range of media players and mobile devices.

Some argue that studios should embrace the transformation and distribute movies via Internet download (henceforth we use the industry term *digital sell-through* or **DST**) and streaming subscription services. For example, Smith and Telang (2012) suggest that in order to avoid piracy, releases to DVD and digital channels should be done earlier. Another argument in favor of releasing movies earlier for download is based on the notion that movie content is perishable (August et al., 2014), so studios may want to monetize secondary channels by releasing them as early as possible to maximize a movie's total life cycle revenues.

However, Internet distribution threatens the viability of established channels like theaters, DVDs, and cable TV pay-per-view services. The earlier movies are released for Internet download, the higher will be the cannibalization of revenues from these traditional channels. Therefore, studios and other content producers are faced with the dilemma of embracing distribution via the Internet and competing against piracy, while continuing to serve the interests of existing distributors and to protect revenues from traditional channels.

Because of the trade-offs to be considered when trying to decide when to release movies across different channels, there is substantial analytical work that models these trade-offs. The literature on this topic goes back a few decades under the umbrella of channel strategy and the timing and pricing of releases in primary and secondary channels. The fundamental managerial problem modeled is when and at what price should a product be released in a secondary channel,

to maximize revenues across the different channels (Prasad, 2004). There is also some empirical research that uncovers the existing timing of releases in secondary channels (Luan and Sudir, 2006; Hennig-Thirau et al., 2007), mostly in the context of DVDs as a secondary channel. But as far as we know, there is no empirical work that examines empirically how movies are being released in the trio of theater, DVD, and Internet channels.

In this paper, we track movie releases in theaters in the 2012-2015 period, and then we record the corresponding release dates and prices for DVD and three DST services: iTunes, Amazon, and YouTube. In most situations, DST is typically released simultaneously with digital rental, so our data is representative of both. We find evidence that, during this period, the length of the DVD window has been relatively stable at three to four months, in line with empirical evidence and models that suggest there is an optimal DVD release window. We also find that the DST release window has been shrinking at a relatively fast rate and it has converged towards the DVD window. This trend is evident even after controlling for other factors that may affect movie release timing, such as season, box office revenues, and accounting for fixed effects across studios and channels. Moreover, in the first quarter of 2015, we find that on average DST was released earlier than DVD, effectively becoming the first secondary channel after theater.

Our study also investigates whether this trend is bound to continue, by testing both a linear model with steady rate of change in the DST release window, and a non-linear model with a decreasing rate of change in the DST window. The non-linear model has a better fit with the data, suggesting that pace at which the digital channel is encroaching in the theater window is starting to slow down.

Next we provide a review of the literature, followed by hypothesis formulation, empirical framework and model, results, discussion, and conclusions.

EXISTING THEORY AND RESEARCH ON RELEASE WINDOWS

The optimal release windows for movies is a topic generating controversial views in the literature, because of the inherent trade-offs involved. There are two major categories of factors that should affect the timing of a movie release in DVD and DST: cross-channel revenues and piracy.

Cross-channel Revenues. There is an optimal set of release dates for a movie across channels, based on the revenues generated by each channel and the cannibalization of revenues across channels. This problem has been studied in the broader context of the timing of product introductions (Prasad, 2004). If the secondary channel release is done too early, revenues from the primary channel will be cannibalized. If the release is too late, then revenues for the secondary channel will be affected, assuming that movies have entertainment value that decays over time. The faster the rate of decay, the less durable it is. If a movie has high durability, one would expect the release windows to come later than those with low durability. For example, Disney's movie Frozen was in more than 1,000 theaters in the U.S. for 4.5 months, an unusually long theater window, while the release in DST was four months after theater release. Interestingly, Frozen's revenue per theater had a sharp decline from $2.5 million to $1.9 million after it was released in DST, which suggests Frozen could have resisted an even longer period in the wide screens if DST had been further delayed. This example shows the potential for cannibalization of theater revenues by digital channels.

The trade-off between cannibalization of primary channel revenues and durability of a movie can be summarized as follows: the later a movie is released to DVD and DST, the less cannibalization of theater revenues, but the losses for the secondary channels could be higher, because consumers' valuation of content decreases over time. Based on these theoretical trade-offs, there is empirical evidence that suggests there is indeed an optimal release time in practice.

Luan and Sudir (2006) and Hennig-Thirau et al. (2007) find empirically that the optimal release window is about 2.5 to 3 months. But the optimal release is moderated by the characteristics of the content, including durability. August et al. 2014 modeled the trade-offs and found that strategic movie releases should vary depending on its durability.

Piracy. Smith and Telang (2012) and Danaher et al. (2010) suggest that in order to reduce the losses from piracy, the release windows of DVD and digital versions of movies should happen earlier. Implicit in this argument is that a sizeable share of consumers, given the option to pay a reasonable price for a non-pirated version of a movie, will be willing to do so. The problem is that, up until recently, before DVD/DST release there has been no legal option for consumers to watch a movie in a digital channel, and the only alternative is to watch pirated versions. Until recently, major studios have preferred to respect the 3-month theater window to cater to theater owners and to protect theater revenues. That has left piracy of movies uncontested during the theater window, providing the pirates the opportunity to thrive and become increasingly sophisticated.

In contrast to the argument that DVD/DST release dates should come earlier to curb piracy, there is the possibility that piracy is a complement to legitimate content. The underlying rationale is that piracy and movie sales are complementary, because illegal viewing creates viral or promotional effects that lead to overall higher movie sales. If that is the case, then the traditional practice of delaying DVD/DST releases could be justified. But while there are a few studies that appear to support this argument (Martikainen, 2011; Smith and Telang, 2009), the overwhelming evidence in the literature suggests that piracy has a negative effect on movie sales (Smith and Telang, 2012).

One partial solution to the increasing piracy problem is to release legitimate digital copies of a movie earlier, within the 3-month theater window. There is evidence that suggests that this is a viable solution to curb piracy. Danaher and Waldfogel (2012) found that lags between U.S. and international release dates caused a 7% reduction in movie sales. Smith and Telang (2012) found that an increasing lag between the DVD dates and the first illegal DVD source reduced DVD sales by 2%. Therefore, earlier releases of legitimate digital copies of a movie are bound to reduce piracy.

Each secondary channel brings with it the possibility of pirate copies, but the economics significantly changed with the digital revolution. Before movies could be solid in digital format, it was more difficult for piracy to thrive, and many consumers had little choice but to wait for movies to be released in video cassette or cable to enjoy them at home. Then pirated copies of DVDs emerged, and movie piracy increased. Now, with the possibility to distribute content via the Internet, movie piracy is rampant. Moreover, consumers are increasingly demanding content anywhere and anytime, and given the option for pirates to use the Internet to distribute illegal copies fast and inexpensively, the motion picture industry is under increasing pressure to re-consider the release windows of movies in DVD and DST. In this paper, we provide the results of more than three years of data collection and analysis on movie release windows in theater, DVD, and DST. This is a descriptive analysis that seeks to understand how studios are responding to the increasing pressures to bring DVD and DST release dates closer to the theater release date.

MODEL SETUP AND HYPOTHESES

Let t_{dvd} and t_{dig} be the release dates for DVD and digital sell-through respectively, relative to the theater release date T. Release windows for DVD and digital sell-through will then be $W^{dvd} = t_{dvd} - T$ and $W^{dig} = t_{dig} - T$. Figure 1 illustrates this notation.

Figure 1. Model Setup
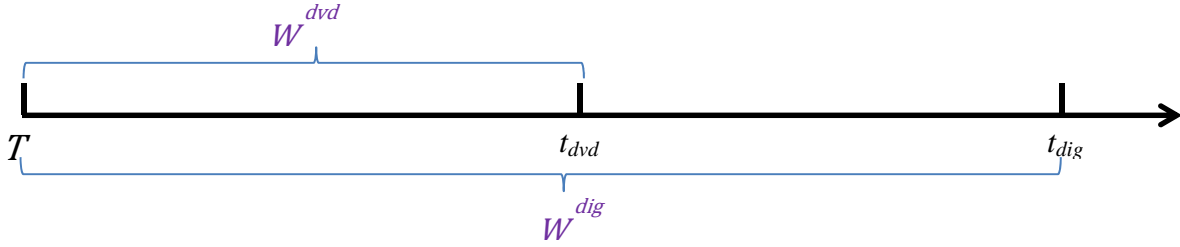
Since the 1990s, the DVD release date has been converging towards the theater release date, resulting in a reduced DVD release window. In a span of 15 years, the DVD release window has shrunk almost in half, from an average of 200 days in 1998 to 115 days in 2014 (Tribbey, 2015). This trend suggests that the cannibalization of theater revenues is lower than losses due to a delayed DVD release. Moreover, consistent with the findings of Luan and Sudir (2006) and Hennig-Therau (2007) that an optimal DVD window is 2.5 to 3 months, there is still room for the DVD release date to converge towards theater release, resulting in a reduced DVD release window. Therefore, we hypothesize:

Hypothesis 1: The DVD release window shrinks as t^{dvd} converges towards the theater release date T.

The next question of interest concerns the release window for DST services like iTunes. Given the proliferation of Internet-based distribution services for movies, competitive pressures across online distributors, increasing demand from consumers to download their movies, and the

threat of piracy, we hypothesize that the release date for DST services has been converging towards the theater release date, resulting in a reduced DST release window.

Hypothesis 2a: The digital sell-through window shrinks as t^{dig} converges towards the theater release date T.

Building on the tenet from modeling and empirical research that suggests there is an optimal DST release window, it is reasonable to assume that the DST window shrinks at a decreasing rate, asymptotically to the optimal release date. Therefore, we hypothesize:

Hypothesis 2b: The digital sell-through window shrinks at a decreasing rate.

Next, we develop the empirical model and describe the data collected for this study.

EMPIRICAL MODEL AND DATA

We collected data on 131 movies released in theaters during the period January 2012 and March 2015. The data includes release dates and prices for theaters, DVD, and the DST services of Apple (iTunes), Amazon, and YouTube. In order to test the hypotheses, we first developed a model of the factors that affect the release date of movies into secondary channels. Based on the literature, we identified the following variables that affect release dates:

Price: The optimal time to release a product for sale in a secondary channel depends on its price. Even though the price is dependent on product positioning decisions, content quality, and other industry practices (e.g., negotiations between studios and distributors), release date in a channel and the respective price are simultaneous decisions, so there is a risk of endogeneity when including price as a predictor of the release date. We address this endogeneity problem by using instrumental variables for price.

Season: The traction that movies get in the market during the summer and holiday season may increase the potential revenues during the theater window, leading to a later release in secondary channels like DVD and DST. Therefore, we control for summer and Christmas holiday seasons and hypothesize that movies released in theaters during these two seasons will be released relatively later in DVD and DST. We categorize May – August as summer months and December as end-of-year holiday.

Quality vector: We consider two movie quality variables, opening weekend box office as a signal of quality from the consumer side, and movie production budget as a proxy for the quality intended from the supply side.

Opening Weekend Box office: Box office revenues indicate the quality of the movie based on differences in box office revenues. Here, the literature is mixed. Lehman and Weinberg (2000) find that success in the first channel is a predictor of success in the secondary channel, so box office revenues embed two countervailing effects on release dates: Release late to save box office revenues vs. release early because box office revenues predict that secondary channel revenues will be higher. We use box office during opening weekend in our model is that it is a very good predictor of the total box office, but it is less correlated with the other variables.

Production budget: We use production budget as another possible predictor of movie quality. The budget includes the cost of making the movie and excludes marketing budget.

Based on the price and quality discussion, the model for the DST release window is:

$$W^{dig} = \alpha T + \eta P + \delta\, Season + \gamma Q + \beta\, Studio + \sigma Dig + \epsilon, \qquad (1)$$

where α, the coefficient of *T*, is the estimate of interest. In this model, *T* is the theater release date, indexed to a fixed date in the past (January 1, 2011). That is, we are interested in knowing whether over the period of the study, the length of the DST window is changing, after controlling

for other factors that may affect the release date. *P* is the DST price, $\boldsymbol{Q}$ is the vector of quality

variables (includes opening box office revenues and production budget), *Studio* is a set of

dummy variables for each major studio in the study (Paramount, Fox, Universal, Sony, Disney,

and Warner). *Dig* is a set of dummy variables that represent the fixed effect of each DST

services, and ϵ is the error term.

Endogeneity

The price of a movie in the different channels is typically set in relation to the release date

chosen. Therefore, there is a simultaneity effect that makes this variable endogenous. Also, the

price may be endogenously determined by other variables that are also correlated with the release

window length, which could bias the results. To address these potential endogeneity problems

with *P*, we perform a 2SLS regression using the following variables as instrumental variables for

P: theater release index *T*, *average rating* and *profit in theaters*. The average rating is an

indicator of the price that the market can afford, based on consumer ratings of the content. We

use a rating the combines IMDB and Rotten Tomatoes ratings. The profit margin of a movie

(box office revenues divided by production budget) can influence the price of the movie in the

secondary channel. A Hausman test does not support the hypothesis that endogeneity is present

(Digital: $\chi^2(10) = 8.78$, *p*=0.64), and the main results are consistent in both OLS and 2SLS

estimations.

The model for the DVD window is almost the same as the one for DST, except there are no

DST service dummies.

$$W^{dvd} = \alpha T + \eta P + \delta \, Season + \boldsymbol{\gamma Q} + \beta \, Studio + \epsilon \qquad (2)$$

RESULTS

In this section, we report results with OLS and 2SLS regressions even though we do not find evidence of endogeneity based on the Hausman test. On the other hand, we do find evidence of heteroskedasticity for the digital release window model using the Breusch-Pagan test for constant variance (Digital: $\chi^2(1) = 81.30$, $p < 0.001$) but not for the DVD model (DVD: $\chi^2(1) = 1.75$, $p=0.19$). Therefore, we report results with robust standard errors to account for the existence of heteroskedasticity. There are no multicollinearity problems in our regressions because the lowest correlation between two regressors is 0.65, which was confirmed by the resulting Variance Inflation Factors of 1.74 and 1.73 for the DST and DVD models, respectively.

Interestingly, we find the DVD window did not change much during the period of our study. Table 1 presents the results of the estimation of the DVD window model. The DVD window has remained stable over the period of the study after controlling for other factors that affect the DVD release date. The coefficient for *T* is small and statistically significant (-0.016, p = 0.02). This result is consistent in the 2SLS run (-0.03, p = 0.05). Although cannot reject Hypothesis 1, we find that the DVD window is shrinking marginally, about one day about every two months.

Table 1. Regression Results for the DVD Window

Variable	Coef.	Robust SE	t
T	-0.02*	0.01	-2.41
P	-0.23	0.90	-0.25
Budget ($MM)	0.45	0.04	1.15
Box Office ($MM)	0.11	0.08	1.26
Season	-0.80	4.81	-0.80
Fox	1.07	6.45	-0.31
Universal	-0.30	7.16	-0.87
Disney	0.69	8.97	-1.24
Sony	-0.13	6.05	-0.81
Warner	2.05	8.51	-0.41
Constant	130.63***	19.94	6.55
R-squared	**11.7%**		

Note: * = p<0.1, ** = p<0.01, *** = p<0.001

In contrast, we find evidence that the DST window has shrunk towards the theater release

date (see Table 2). The coefficient estimate for *T*, our variable of interest, is -0.122 ($p < 0.001$).

That is, the later in the study period that a movie was released, the shorter was its DST window,

after controlling for other factors that can affect the window. So we find support for Hypothesis

2. Over time, the DST release date has been converging towards theater release at an average rate

of approximately 4 days per month for the 3+ years of our study. The 2SLS results for the DST

window in Table 2 are similar to the results presented for the DVD window in relation to the

coefficients that are significant. In particular, the coefficient estimate for *T* is comparable and

significant at -0.125 ($p < 0.001$).

Table 2. Results for Digital Sell-Through Window – Linear Model

Variable	Coef.	Robust SE	t
T	-0.12***	0.01	-13.36
P	-0.27	1.42	-0.19
Budget ($MM)	0.02	0.06	0.31
BoxOffice ($MM)	0.27***	0.10	2.64
Season	24.69***	5.72	4.32
Fox	1.02	7.75	0.13
Universal	8.32	10.05	0.83
Disney	35.16***	10.19	3.45
Sony	0.53	8.16	0.06
Warner	12.46	8.60	1.45
Amazon	-0.61	6.29	-0.10
YouTube	5.09	6.34	0.80
Constant	236.32***	25.52	11.29
R-squared	**53.0%**		

Note: * = p<0.1, ** = p<0.01, *** = p<0.001

One interesting finding is that the coefficient for Disney is the largest and consistently

significant studio dummy in both the OLS and 2SLS run (OLS: coefficient = 35.2, $p < 0.001$;

2SLS: coefficient = 109.7, $p < 0.001$). This suggests that Disney has power to sustain a longer

DVD window than the other studios and can afford to hold the DST release by at least a month

on average, compared to the other studios. No other studio had consistently positive and

significant coefficients in both runs and only Warner Brothers had a positive and significant

coefficient in one of the runs (OLS: coefficient = 12.46, p = 0.15; 2SLS: coefficient: 70.4, $p <$

0.001).

In order to test hypothesis 3, that the DST window is shrinking at a decreasing rate, we

developed a log-linear version of the DST model, as follows:

$$ln \, W^{dig} = \alpha \, lnT + \eta \, lnP + \delta \, Season' + \boldsymbol{\gamma \, lnQ} + \beta \, Studio' + \sigma Dig' + \epsilon. \qquad (3)$$

Table 3. Results for Digital Sell-Through Window – Non-linear Model

Variable	Coef.	Robust SE	t
T	-0.79***	0.04	-0.71
P	-0.05	0.12	-0.29
Budget ($MM)	0.01	0.02	0.04
BoxOffice ($MM)	0.01	0.01	0.03
Season	0.15***	0.03	0.21
Fox	0.00	0.05	0.13
Universal	0.01	0.06	0.10
Disney	0.21***	0.21	0.13
Sony	-0.01	0.05	0.31
Warner	0.10*	0.05	0.10
Amazon	-0.00	0.04	0.20
YouTube	0.03	0.04	0.08
Constant	9.91***	0.31	0.11
R-squared	**60.0%**		

Note: These results are for the log-linear model in Equation 3.
* = p<0.1, ** = p<0.01, *** = p<0.001

The results of the both OLS and 2SLS log-linear regressions provide a model fit of 60% R-

squared, compared to the 53% R-squared of the linear model. Therefore, we find modest support

for the hypothesis that the DST window is shrinking at a decreasing rate, since the log-linear

model has a better fit. As we will see in the next section, this moderate difference in model fit

between the linear and non-linear models can be explained by the fact that the inflection of the

slope of the DST window curve just started in 2014.

DISCUSSION

One of the surprising findings in our study is that the DVD release window has remained stable since 2012. The DVD release window is barely shrinking, controlling for other factors that may affect the DVD release date, and accounting for studio fixed effects. This is in sharp contrast with the constant and significant shrinkage in prior years as Figure 2 shows. One possible explanation is that industry executives now recognize that further shrinkage of the DVD window will come at the expense of box office revenue losses. For the movies in our sample, we tracked the cumulative theater box office revenues. Figure 3 shows that 99% of box office revenues were captured within four months after theater release, although 95% are captured at 2 months. For durable movies the window is even longer. Disney's *Frozen*, for example, accumulated 95% of its domestic box office revenues in 3.5 months. So studios and theater owners may prefer to protect the majority of theater revenues from cannibalization from the secondary channels.

Figure 2. DVD and Digital Sell-Through Release Windows (1998-2014)
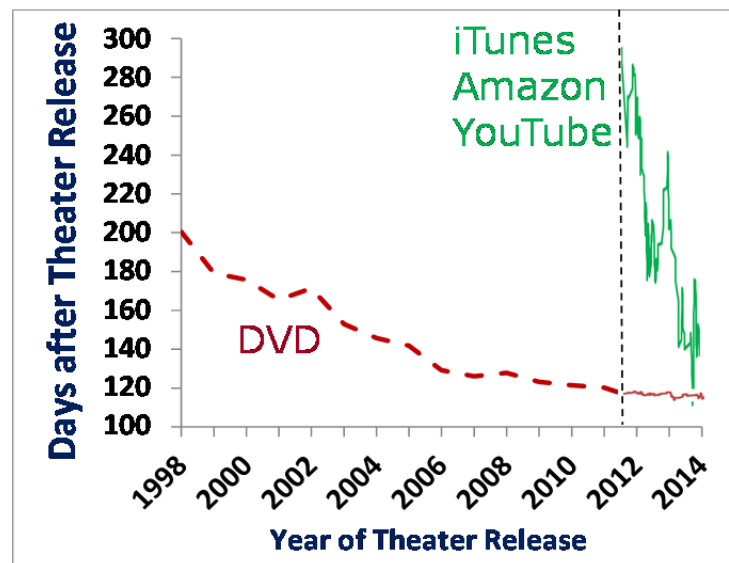
Sources: 2012-2014 Fitted values of 2SLS regression in our study.
1998-2012: Tribbey (2014)

Figure 3. Cumulative Box Office Revenues
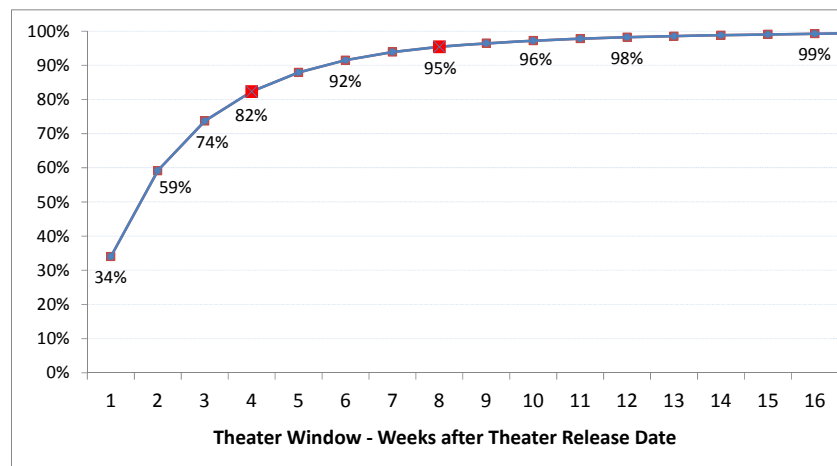
Note: Cumulative box office revenue curve for movies in our sample.

Another important finding is that, while the DVD release window has remained stable since 2012, the release date for DST (and rental) services via iTunes, Amazon, and YouTube has been converging towards the theater release date, at the expense of DVD and possibly theater revenues. In fact, as Figure 2 shows, for movies released in theater in summer 2014, the DST and DVD windows have finally converged. However, as August et al. (2014) suggest, there is variability in this shrinkage of the DST window, depending on the durability of the content. We find that Disney, which produces durable content for children, has a longer DST window. Disney movies are known to have relatively high durability because of their long-term appeal to children, which creates cross-selling opportunities with other complementary products like merchandise and resort experiences.

Based on our results, the DST release date has been approaching the DVD release date at a steady and significant average rate of about 4 days per month. At this rate, we have seen the DST release window shrink in half and converge with the DVD release in about two years. The average DST window in the 2nd quarter of 2012 was 255 days, compared to 114 days in the 2nd quarter of 2014. This reduced window is comparable to the 113 days average DVD window in our sample,

but the pace of reduction is in sharp contrast with the 15 years it has taken for the DVD window to shrink in half.

Looking at the trends for theater releases after summer of 2014, some movies already are being released simultaneously in both DVD and DST, and there are multiple cases where DST releases occur before DVD release. Figure 3 shows the results for the full period of our study. The graph contains smoothed fitted curves from our regressions, and trend lines based on the coefficient estimates. First, you can see the slow declining trend of the DVD window, approximately one day every two months according to our estimates. In contrast, there is a sharp decline of the DST window. The convergence of the two curves occurs for movies released in theaters in July 2014. Then the trends continue for both DVD and DST, which means that the DST window has continued to shrink past the DVD window, encroaching on the 3-month theater window.

Figure 3. DVD and Digital Sell-Through Release Windows (Jan. 2012 – Mar. 2015)
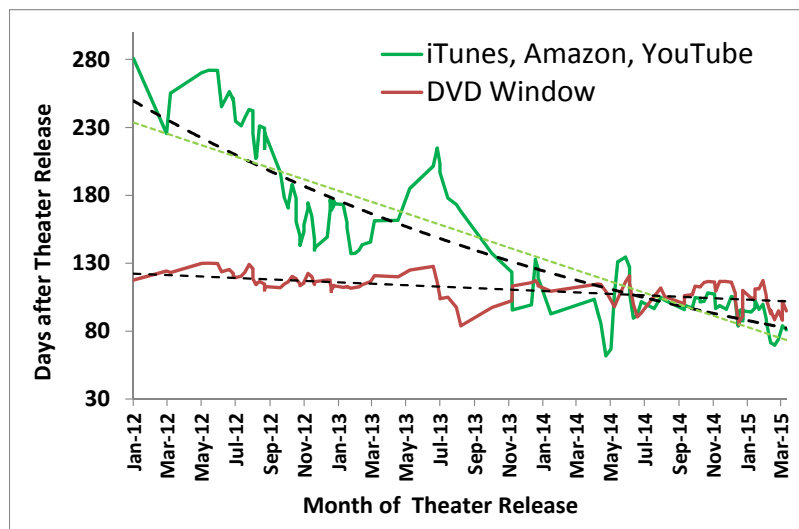
The graph also shows linear and non-linear trend lines for the DST window. The non-linear trendline has a slightly better fit, in line with our results. So there is support for Hypothesis 3, that

the DST window is shrinking at a declining rate. If this trend continues, the DST window is bound to come to a halt at some point.

Based on our analysis of the cumulative theater revenues, it is possible that the DST release window will settle somewhere between two and three months after theater release, in line with existing literature that has empirically determined this may be the optimal release time for a movie's secondary channel. This possible outcome dictates a move by DVD distributors to advocated earlier releases in their channel, to compete with DST. Otherwise DVD channel distribution is bound to suffer a serious decline, as it gives in to DST's earlier and convenient delivery of content to consumers.

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